General

Guideline Title

ACR Appropriateness Criteria® follow-up of lower-extremity arterial bypass surgery.

Bibliographic Source(s)

Majdalany BS, Rybicki FJ, Dill KE, Bandyk DF, Francois CJ, Gerhard-Herman MD, Hanley M, Kalva SP, Mohler ER III, Moriarty JM, Oliva IB, Schenker MP, Weiss C, Expert Panel on Vascular Imaging. ACR Appropriateness CriteriaÂ® follow-up of lower-extremity arterial bypass surgery. [online publication]. Reston (VA): American College of Radiology (ACR); 2013. 10 p. [104 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Koss SA, Yucel EK, Rybicki FJ, Baum RA, Desjardins B, Flamm SD, Foley WD, Jaff MR, Mammen L, Mansour MA, Narra VR, Expert Panel on Vascular Imaging. ACR Appropriateness Criteria® follow-up of lower-extremity arterial bypass surgery. [online publication]. Reston (VA): American College of Radiology (ACR); 2009. 5 p.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Follow-up of Lower-Extremity Arterial Bypass Surgery

Variant 1: Infrainguinal vein graft. Asymptomatic patient. Surveillance.

Radiologic Procedure	Rating	Comments	RRL*
Ankle brachial index and single level pulse volume recording	9		O
US lower extremity with Doppler	8		O
MRA lower extremity without and with contrast	3		O
MRA lower extremity without contrast	2		O
CTA lower extremity with contrast	2		☢☢☢
Arteriography lower extremity	1		☢☢☢

Radiologic Procedure	Rating	Comments	*Relative Radiation Level
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Infrainguinal vein graft. Pain and/or swelling and/or ischemia and/or abnormal ankle brachial index.

Radiologic Procedure	Rating	Comments	RRL*
Ankle brachial index and single level pulse volume recording	9		O
Arteriography lower extremity	9		☢☢☢
US lower extremity with Doppler	8		O
MRA lower extremity without and with contrast	8	See statement regarding contrast in text below under "Anticipated Exceptions."	O
CTA lower extremity with contrast	8		☢☢☢
MRA lower extremity without contrast	5		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

Peripheral arterial occlusive disease (PAOD) affects nearly 8 million patients in the United States and up to 20% of patients in the primary care setting. Increased prevalence among older patients, diabetics, and those with end-stage renal disease is well established. This disease progresses from an asymptomatic process to claudication and then to critical limb ischemia. Over the past few decades, the increasing variety of pharmacological agents and the improving efficacy of endovascular interventions for PAOD have led to fewer lower-extremity arterial bypass procedures, according to national trend studies, with comparable quality-of-life and amputation-free survival outcomes. Lower-extremity arterial bypass procedures are also used in patients who are technically unsuitable candidates for aggressive medical management or endovascular revascularization.

A lower-extremity arterial bypass is categorized by the anastomoses of the created conduit and use of autogenous vein, prosthetic graft, or biologic graft. Historically, autogenous, greater saphenous venous grafts are preferred over prosthetic or biologic grafts, particularly for below-the-knee bypass. Prosthetic grafts are the mainstay when the greater saphenous vein has been previously harvested or is currently unsuitable; biologic graft use is limited to infected fields. Studies comparing primary patency, secondary patency, and limb-salvage rates of graft materials further support the preference for autogenous bypass graft.

Bypass failure stems from the development of stenoses within or adjacent to the graft and, ultimately, thrombosis, if left uncorrected. Although early bypass failures reflect technical errors in placement, later failures are usually due to intimal hyperplasia or the progression of underlying disease at anastomotic sites. During the first postoperative year, up to 30% of venous grafts develop stenoses. There is evidence suggesting that repair of these stenoses, by either surgical or endovascular means, extends the patency of venous bypass grafts. Moreover, patency following revision of a thrombosed vein graft is inferior to patency following revision of a stenotic graft prior to thrombosis.

There is strong evidence that using intraoperative, duplex ultrasound (US) during the graft reduces early graft failures. In fact, the most sensitive predictor of subsequent graft stenosis formation is an abnormal duplex US during initial surgery.

Previously, postsurgical surveillance was limited to clinical observation of recurring symptoms, ankle brachial index (ABI) measurement, and segmental volume recordings. Over the past 2 decades, use of routine duplex US for asymptomatic patients following infrainguinal bypass has gained acceptance. Further imaging may be warranted for anatomic mapping prior to open surgical or endovascular intervention for dysfunctional grafts as identified by clinical symptoms or duplex US.

Digital subtraction angiography (DSA) remains the standard imaging modality reference for precise evaluation of the severity, location, and

character of graft stenoses as well as evaluation of the quality of native vessels proximal and distal to the graft prior to reintervention. More recently, magnetic resonance angiography (MRA) and computer tomography angiography (CTA) have become more accepted as noninvasive imaging substitutes for DSA. These studies may be warranted prior to urgent intervention even in cases of an acutely threatened limb after bypass graft failure.

Ultrasound

Vein graft surveillance is most commonly performed using duplex US, which has been a method of vein graft surveillance for more than 20 years.

In clinical practice, duplex US of the bypass conduit is routinely performed at the time of implantation and at regular intervals for surveillance. The technique involves the sequential study of a graft from the proximal to distal anastomosis, with measurement of peak systolic flow velocity (PSFV) and peak systolic flow velocity ratio (PSFVR), which is the ratio of peak systolic velocity to the systolic velocity in the adjacent normal segment. There is evidence to suggest that PSFVR is the most sensitive indicator of a graft stenosis. A PSFVR of >2.0–2.5 is often considered representative of a significant stenosis, although some reports suggest a higher value of 3.0 to 3.5 is a more appropriate threshold for intervention. Other values that can signify a graft stenosis are a PSFV >200 cm/sec at any point in the graft or a midgraft PSFV <45 cm/sec, which may indicate high outflow resistance (suggesting progressive atherosclerosis in the runoff vessels). However, low PSFV can also be present in normal large-caliber vein grafts. Additionally, phase-sensitive US speckle tracking is being studied as a potential means for assessing local wall strain to detect neointimal hyperplasia.

No large, randomized, controlled trials support the use of duplex US for either autologous or prosthetic graft surveillance. Moreover, several studies have reached different conclusions. Separate publications by several different authors reported that intraoperative, predischarge, and early surveillance duplex US can detect technical problems in grafts at higher risk for future stenoses or occlusions. One study of 165 grafts showed a significant benefit in assisted primary and secondary patency for autologous grafts at 3 years but no benefit in patency for the surveillance of prosthetic grafts. Additionally, a large, nonrandomized study of 615 bypasses found significant improvement in secondary patency and limb salvage for grafts followed by duplex US and ABI when compared with clinical surveillance alone.

However, other trials comparing duplex US surveillance versus clinical follow-up of lower-extremity bypass grafts have reached contrary conclusions. A multicenter prospective trial of 594 patients was randomized into a clinical or duplex US follow-up group for 18 months. The primary, primary assisted, and secondary patency rates were nearly identical for both groups (69%, 76%, 80% versus 67%, 76%, 79%, respectively), but the diagnostic costs were significantly higher for the US group. The investigators concluded that using US for routine lower-extremity bypass graft surveillance showed no additional health benefit, but it incurred greater cost. Additionally, multiple authors have reported that duplex US does not enhance lower-extremity arterial bypass graft patency, particularly for prosthetic grafts.

Digital Subtracted Angiography

Although DSA remains the gold standard for diagnosing PAOD prior to reintervention, it generally plays no role in surveillance of otherwise well-functioning grafts. Access-site hematoma, arterial dissection, and thrombosis are known local complications that result from the procedure and occur in up to 8% of patients. Serious systemic complications are also possible. These occur less frequently with increasing operator experience.

Magnetic Resonance Angiography

Contrast-enhanced MRA is a widely available and commonly used noninvasive and low-risk examination that provides a highly accurate, sensitive, and specific evaluation of the vasculature. At present, contrast-enhanced MRA shows an increased ability to properly evaluate bypass grafts and bypass graft inflow and outflow vessels. Studies by several authors confirmed excellent sensitivity and specificity with MRA use, with the latter study also detecting additional stenoses not seen on US but ultimately confirmed by DSA. Studies using high-resolution, three-dimensional (3-D) fast-spin echo techniques have accurately measured inner volumes of bypass grafts and elucidated bypass graft layers, which can be useful in further prospective studies of graft maturation. Additionally, new gadolinium-based contrast agents that have higher relaxivity are in development and promise an improved diagnostic performance, particularly in distal vessels.

Given the growing concerns about nephrogenic systemic fibrosis research of low-dose and nonenhanced MRA is increasing. Preliminary studies at 3.0T, with low-dose contrast, have focused on high spatial resolution using dedicated multichannel array coils and accelerated parallel acquisition and continuous table movement with improved spatial resolution time-resolved imaging sequences. Nonenhanced MRA techniques have used relatively new technologies that show encouraging early results. Further investigation of these methods is needed, particularly to improve diagnostic performance in calf and pedal vessels.

Computed Tomography Angiography

Technological improvements in multidetector CTA, combined with rapid image acquisition, lower radiation doses, lower complication rates, and 3-D volumetric imaging, when compared with DSA, yielded tremendous interest in its use as a noninvasive imaging tool for evaluating PAOD and

lower-extremity arterial bypass grafts. Early studies suggested CTA was a viable substitute for DSA. Multiple studies have demonstrated the accuracy of CTA for evaluating PAOD and have shown strong concordance between CTA and DSA for establishing an accurate treatment plan. One study concluded that multidetector CTA was reliable and accurate, after using duplex US to assess lower-extremity bypasses to detect graft-related complications. Note that CTA accuracy decreases in severely stenotic lesions or smaller caliber vessels, particularly in heavily calcified vessels or areas adjacent to metallic artifact. However, there is a potential for dual-energy CTA to exploit elemental attenuation changes and, hence, differentiate between calcium and iodine.

The choice between CTA and MRA for evaluating clinically suspected lower-extremity bypass grafts can be difficult. Both modalities are effective substitutes for DSA in terms of physician confidence and clinical outcomes. However, the choice of modality is often made by a combination of availability and user expertise.

Summary

- Lower-extremity arterial bypass has been performed less frequently since the advent of effective endovascular techniques and aggressive medical management; however, it is still useful when either of these paths fail.
- Autogenous vein grafts have the highest patency rates, with the natural history of graft failure progressing from stenosis to thrombosis.
- Duplex US, ABI, and single-level pulse volume recording are adjuncts to clinical examination for the surveillance of asymptomatic grafts and can be particularly useful in suspected graft failure if prior examinations are available for comparison.
- DSA, MRA, and CTA are low-yield and unindicted examinations in an asymptomatic and otherwise well-functioning graft.
- MRA or CTA can confirm suspected abnormalities and are useful for treatment planning in cases of anticipated graft failure.
- Lower-extremity arteriography is best performed at the time of intervention.

Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e., <30 mL/min/1.73 m^2), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73 m^2. For more information, see the American College of Radiology (ACR) Manual on Contrast Media (see the "Availability of Companion Documents" field).

Abbreviations

- CTA, computed tomography angiography
- MRA, magnetic resonance angiography
- US, ultrasound

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Symptomatic or asymptomatic graft stenosis and graft failure following lower extremity arterial bypass surgery

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Cardiology

Internal Medicine

Radiology

Surgery

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations for follow-up of lower-extremity arterial bypass surgery

Target Population

Patients who have had lower-extremity arterial bypass surgery

Interventions and Practices Considered

1. Ankle brachial index and single level pulse volume recording
2. Ultrasound (US) lower extremity with Doppler
3. Magnetic resonance angiography (MRA) lower extremity
    - Without and with contrast
    - Without contrast
4. Computed tomography angiography (CTA) lower extremity with contrast
5. Arteriography lower extremity

Major Outcomes Considered

- Utility of imaging procedures in evaluation of graft patency and graft complications
- Primary, primary assisted, and secondary patency rates

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

Staff will search in PubMed only for peer reviewed medical literature for routine searches. Any article or guideline may be used by the author in the narrative but those materials may have been identified outside of the routine literature search process.

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 10 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis, and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid, but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence (study quality) for each article included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distribute surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. The surveys are completed by panelists without consulting other panelists. The appropriateness rating scale is an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate"; 4, 5, or 6 are in the category "may be appropriate"; and 7, 8, or 9 are in the category "usually appropriate." Each panel member assigns one rating for each procedure for a clinical scenario. The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating.

If consensus is reached, the median rating is assigned as the panel's final recommendation/rating. Consensus is defined as eighty percent (80%) agreement within a rating category. A maximum of three rounds may be conducted to reach consensus. Consensus among the panel members must be achieved to determine the final rating for each procedure.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is proposed as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

This modified Delphi method enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive influence from fellow panelists in a simple, standardized and economical process. A more detailed explanation of the complete process can be found in additional methodology documents found on the ACR Web site (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

One multicenter prospective trial of 594 patients was randomized into a clinical or duplex ultrasound (US) follow-up group for 18 months. The primary, primary assisted, and secondary patency rates were nearly identical for both groups (69%, 76%, 80% versus 67%, 76%, 79%, respectively), but the diagnostic costs were significantly higher for the US group. The investigators concluded that using US for routine lower-extremity bypass graft surveillance showed no additional health benefit, but it incurred greater cost.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures to aid in follow-up of lower-extremity arterial bypass surgery

Potential Harms

Access-site hematoma, arterial dissection, and thrombosis are known local complications that result from digital subtracted angiography and occur in up to 8% of patients. Serious systemic complications are also possible.

Gadolinium-based Contrast Agents

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e., <30 mL/min/1.73 m^2), and almost never in other patients. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73 m^2. For more information, please see the American College of Radiology (ACR) Manual on Contrast Media (see the "Availability of Companion Documents" field).

Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional

information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Majdalany BS, Rybicki FJ, Dill KE, Bandyk DF, Francois CJ, Gerhard-Herman MD, Hanley M, Kalva SP, Mohler ER III, Moriarty JM, Oliva IB, Schenker MP, Weiss C, Expert Panel on Vascular Imaging. ACR Appropriateness CriteriaÂ® follow-up of lower-extremity arterial bypass surgery. [online publication]. Reston (VA): American College of Radiology (ACR); 2013. 10 p. [104 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1998 (revised 2013)

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Vascular Imaging

Composition of Group That Authored the Guideline

Panel Members: Bill S. Majdalany MD (*Research Author*); Frank J. Rybicki, MD, PhD (*Principal Author and Panel Chair*); Karin E. Dill, MD (*Panel Vice-chair*); Dennis F. Bandyk, MD; Christopher J. Francois, MD; Marie D. Gerhard-Herman, MD; Michael Hanley, MD; Sanjeeva P. Kalva, MD; Emile R. Mohler III, MD; John M. Moriarty, MB, BCh; Isabel B. Oliva, MD; Matthew P. Schenker, MD; Clifford Weiss, MD

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Koss SA, Yucel EK, Rybicki FJ, Baum RA, Desjardins B, Flamm SD, Foley WD, Jaff MR, Mammen L, Mansour MA, Narra VR, Expert Panel on Vascular Imaging. ACR Appropriateness Criteria® follow-up of lower-extremity arterial bypass surgery. [online publication]. Reston (VA): American College of Radiology (ACR); 2009. 5 p.

Guideline Availability

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2013 Apr. 1 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 90 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 2013 Apr. 1 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria® follow-up of lower-extremity arterial bypass surgery. Evidence table. Reston (VA): American College of Radiology; 2013. 46 p. Electronic copies: Available from the ACR Web site .

Patient Resources

None available

NGC Status

This summary was completed by ECRI on February 20, 2001. The information was verified by the guideline developer on March 14, 2001. This summary was updated by ECRI on March 29, 2006. This NGC summary was updated by ECRI Institute on June 8, 2010. This summary was updated by ECRI Institute on January 13, 2011 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents. This NGC summary was updated by ECRI Institute on March 7, 2014.

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